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Cancel claims 1 thru 19

20. A method for detecting lightning flicker in an output of a video imaging device having a main picture area comprising an array of pixels for producing successive images at a frame rate, the method comprising:

producing a series of signals from at least one additional picture area adjacent the main picture area, the at least one additional picture area having a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area in a time period substantially shorter than the frame rate;

accumulating a predetermined number of the series of signals to form a series of compound samples; and

filtering the series of compound samples to extract components indicating the lightning flicker.

21. A method according to Claim 20, wherein the time period is equivalent to a line rate of the main picture area.

22. A method according to Claim 20, wherein the at least one additional picture area comprises a plurality of additional picture areas.

23. A method according to Claim 20, wherein the filtering is performed by a bandpass filter tuned to a frequency of the lightning flicker.

24. A method according to Claim 23, wherein each compound sample is formed at a sample rate which is a multiple of a nominal lightning flicker frequency; and wherein the filtering comprises taking a fundamental output component of a ratio-N boxcar.

25. A method according to Claim 24, wherein N is equal to at least one of 3 and 4.

26. A method according to Claim 24, wherein the

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.....
 fundamental output component represents an instantaneous
 complex lighting flicker energy X , with X being averaged over
 time to produce a longer term estimate E' of a lighting
 flicker energy.

27. A method according to Claim 26, wherein the
 longer term estimate E' of the lighting flicker energy is
 produced according to

$$E' = E_0 + E'' (1 - p)$$

where p is a time constant.

28. A method according to Claim 26, further comprising
 deriving a modulus of E' ; and
 comparing the derived modulus to a threshold T to
 give a final estimation of the lighting flicker being present
 if $E' > T$.

29. A method according to Claim 28, further comprising
 selecting an exposure setting for the main picture area for
 recording the lighting flicker.

30. A method for reducing lighting flicker in an
 output of a video imaging device having a main picture area
 comprising an array of pixels for producing successive images
 at a frame rate, the method comprising:

detecting the lighting flicker in the output of the
 video imaging device, the detecting comprising
 producing a series of signals from at least one
 additional picture area adjacent the main picture

Abstract

area, the at least one additional picture area having a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area is a time period substantially shorter than that of the frame rate.

accumulating a predetermined number of the series of signals to form a series of compound samples, and

filtering the series of compound samples to
detect components indicating the lightning flickers
and

selecting an exposure setting for the main picture
area for reducing the lighting flicker.

11. A method according to Claim 10, wherein
selecting the exposure setting comprises selecting an exposure
period which is an inverse of a frequency of the lighting
flicker.

32. A method according to Claim 11, wherein the frequency of the lighting filter includes a harmonic thereof.

13. A screen according to Claim 12, wherein the time period is equivalent to a line rate of the main picture area.

34. A method according to Claim 33, wherein the at least one additional picture area comprises a plurality of additional picture areas.

38. A method according to Claim 39, wherein the

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filtering is performed by a bandpass filter tuned to a frequency of the lighting flicker.

36. A method according to Claim 30, wherein each compound sample is formed at a sample rate which is a multiple of a nominal lighting flicker frequency; and wherein the filtering comprises taking a fundamental output component of a radix-4 butterfly.

37. A method according to Claim 36, wherein N is equal to at least one of 3 and 4.

38. A method according to Claim 38, wherein the fundamental output component represents an instantaneous sample lighting flicker energy E , with E being averaged over time to produce a longer term estimate E' of a lighting flicker energy.

39. A method according to Claim 38, wherein the longer term estimate E' of the lighting flicker energy is produced according to

$$E' = E_1 + E' (1 - \alpha)$$

where α is a time constant.

40. A method according to Claim 39, further comprising:

deriving a modulus of E' ; and
comparing the derived modulus to a threshold T to give a final indication of the lighting flicker being present if $|E'| > T$.

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Filtering is performed by a bandpass filter tuned to a frequency of the lighting flicker.

36. A method according to Claim 35, wherein each compound sample is formed at a sample rate which is a multiple of a nominal lighting flicker frequency; and wherein the filtering comprises taking a fundamental output component of a radix-N butterfly.

37. A method according to Claim 36, wherein N is equal to at least one of 3 and 4.

38. A method according to Claim 36, wherein the fundamental output component represents an instantaneous complex lighting flicker energy E , with E being averaged over time to produce a longer term estimate E' of a lighting flicker energy.

39. A method according to Claim 38, wherein the longer term estimate E' of the lighting flicker energy is produced according to

$$E' = \alpha E + E' (1 - \alpha)$$

where α is a time constant.

40. A method according to Claim 39, further comprising:
 deriving a modulus of E' ; and
 comparing the derived modulus to a threshold T to give a final evaluation of the lighting flicker being present if $|E'| > T$.

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41. A method according to Claim 39, further comprising selecting an exposure setting for the main picture area for reducing the lighting flicker.

42. A lighting flicker-detecting video camera comprising:

a main picture area comprising an array of pixels for producing successive images at a frame rate;

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

accumulation means for summing a predetermined number of the series of signals to form a series of compound samples; and

filter means for filtering the series of compound samples for detecting components indicating the lighting flicker.

43. A video camera according to Claim 42, wherein said at least one additional picture area is defined by a strip of pixels along one side of said array.

44. A video camera according to Claim 43, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

45. A video camera according to Claim 42, further

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comprising:

main gain control means for said main picture area;

and

additional gain control means for said at least one additional picture area that is independent of said main gain control means.

46. A video camera according to Claim 42, wherein said filter means comprises a radix-2 butterfly.

47. A video camera according to Claim 46, further comprising an averaging circuit connected to an output of the radix-2 butterfly.

48. A video camera according to Claim 47, wherein said averaging circuit comprises a first-order auto-regressive filter.

49. A video camera according to Claim 42, further comprising:

an automatic exposure control circuit;

a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the lighting filter or a harmonic thereof; and

control means for selectively connecting said automatic exposure control circuit and said second exposure control circuit to said main picture area for controlling exposure thereof based upon an output of said filter means.

50. A video camera comprising:

a main picture area comprising an array of pixels

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For producing successive images at a frame rate:

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples; and

a filter for filtering the series of compound samples for detecting components indicating the lighting flicker.

50. A video camera according to Claim 49, wherein said at least one additional picture area is defined by a strip of pixels down one side of said array.

51. A video camera according to Claim 50, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

52. A video camera according to Claim 50, further comprising:

a main gain control circuit for said main picture area; and

an additional gain control circuit for said at least one additional picture area that is independent of said main gain control circuit.

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for producing successive images at a frame rate;

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples; and

a filter for filtering the series of compound samples for detecting components indicating the lighting flicker.

51. A video camera according to Claim 50, wherein said at least one additional picture area is defined by a strip of pixels over one side of said array.

52. A video camera according to Claim 51, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

53. A video camera according to Claim 50, further comprising:

a main gain control circuit for said main picture area; and

an additional gain control circuit for said at least one additional picture area that is independent of said main gain control circuit.

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for producing successive images at a frame rate;

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples; and

a filter for filtering the series of compound samples for detecting compenence indicating the lightning flicker.

31. A video camera according to Claim 30, wherein said at least one additional picture area is defined by a strip of pixels across one side of said array.

32. A video camera according to Claim 31, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

33. A video camera according to Claim 30, further comprising:

a main gain control circuit for said main picture area; and

an additional gain control circuit for said at least one additional picture area that is independent of said main gain control circuit.

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54. A video camera according to Claim 53, wherein said filter comprises a radix-2 butterfly.

55. A video camera according to Claim 53, further comprising an averaging circuit connected to an output of the radix-2 butterfly.

56. A video camera according to Claim 55, wherein said averaging circuit comprises a first-order auto-regressive filter.

57. A video camera according to Claim 56, further comprising:

an automatic exposure control circuit;
a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the lighting flicker or a hysteresis thereof; and
a control circuit for selectively connecting said automatic exposure control circuit and said second exposure control circuit to said main picture area for controlling exposure thereof based upon an output of said filter.